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December 2, 1986

TMI-2 Cleanup Project Directorate
Attn: Dr. W. D. Travers
Director
US Nuclear Regulatory Commission
c/o Three Mile Island Nuclear Station
Middletown, PA 17057

Dear Dr. Travers:

Three Mile Island Nuclear Station, Unit 2 (TMI-2)
Operating License No. DPR-73
Docket No. 50-320
TMI-2 Cleanup Program - Post-Defueling Monitored Storage (PDMS)

During the meeting between GPU Nuclear senior management and the Nuclear Regulatory Commission on January 14, 1986, post-defueling plans for the damaged Three Mile Island Unit 2 reactor were discussed. At that time, we committed to provide a plan for plant conditions following completion of the Cleanup Program. Attached is a copy of that plan entitled "TMI-2 Cleanup Program - Post-Defueling Monitored Storage."

The planned PDMS configuration described in the attached document is a safe, stable, and secure plant condition which poses no risk to the health and safety of the public. The plant will be secured, monitored and maintained. The remaining amount and location of nuclear fuel will preclude nuclear criticality. Potential off-site exposures will be well below 10 CFR 50, Appendix I guidelines.

As previously discussed with you, this plan will be a principal topic at the upcoming meeting of the Advisory Panel for the Decontamination of the Three Mile Island Unit 2 on December 10, 1986, at Harrisburg, PA.

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An "Environmental Evaluation of TMI-2 Post-Defueling Monitored Storage" will be submitted for your consideration in January 1987 as input to your planned supplement to the Programmatic Environmental Impact Statement. Appropriate License and Technical Specification Change Requests in support of the PDMS plan will be submitted for your approval beginning in the First Quarter of 1987.

Sincerely,

F. R. Standerfer
Vice President/Director, TMI-2

FRS/RER/eml

Attachment

TMI-2 CLEANUP PROGRAM

POST-DEFUELING MONITORED STORAGE

DECEMBER 1986

TMI-2 CLEANUP PROGRAM

POST-DEFUELING MONITORED STORAGE

Prepared By:
GPU Nuclear Corporation

F. R. Standerfer - Director, TMI-2

SUMMARY

The planned Post-Defueling Monitored Storage configuration is a condition that assures protection of public health and safety for an extended period. The plant will be secured, monitored, and maintained. The absence of any significant quantity or configuration of nuclear fuel assures no potential for nuclear criticality. As a result of the Cleanup Program, off-site exposure from TMI-2 will be well below the normal NRC guidelines for operating plants (10 CFR 50 Appendix I). Thus, TMI-2 will not present a hazard to the public health and safety.

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SECTION 1.0
INTRODUCTION

The GPU System goals for completion of the TMI-2 Cleanup Program are to decontaminate and defuel TMI-2 to provide assurance that the plant configuration is safe, stable and secure. The plan for TMI Unit 2 at the completion of the Cleanup Program is described in this report. Post-Defueling Monitored Storage, PDMS, is the term used to refer to this period.

The plant will pose no risk to public health and safety during this monitored storage period. Ongoing monitoring will be in place to ensure maintenance of the condition. The following specific conditions will prevail during monitored storage:

- Nuclear criticality is precluded.
- Fuel has been loaded into canisters and shipped off-site.
- The potential for a significant release of radioactivity has been eliminated.
- Water has been removed from the plant systems; and the potential for inadvertent reintroduction has been minimized.
- Radioactive waste from the above activities has been packaged and shipped off-site or safely stored pending shipment off-site.
- Radiation has been reduced to levels which will allow: (1) continued plant monitoring, (2) performance of required maintenance, and (3) plant inspections.
- Plant conditions and monitoring programs are maintained in accordance with NRC-approved PDMS Technical Specifications.
- A safe, monitored plant condition has been established.

The Overall Cleanup Program Strategy is shown schematically in Figure 1-1. Phase I (Stabilization) is complete and Phase II (Fuel Removal) is underway. Phase III (Decontamination) efforts are increasing. The work scope has been defined with sufficient specificity to ensure that the radiological conditions achieved in the Cleanup Program are appropriate for PDMS.

The criteria presented herein will assure protection of public health and safety, and will meet or exceed normal licensing standards. GPU Nuclear is committed to meeting these criteria in accordance with the accepted principle of limiting worker exposure to As Low As Reasonably Achievable (ALARA).

The Cleanup Program activities and PDMS conditions will continue to be reviewed to assure a safe, stable, secure condition is achieved and maintained. This plan provides the current perspective on the program.

This PDMS approach satisfies the traditional philosophy. The layers of defense are:

1. Inherent stability - The plant will be in a condition which is stable, quiescent, benign and not prone to transients or accidents. This condition is categorized by:
   - residual fuel configuration will preclude criticality
   - essentially no water
   - residual radioactivity reduced and contained
   - cold, depressurized

2. Effective containment - the remaining radioactivity will be isolated from the environs by protective structures, including:
   - closed piping systems
   - sealed cubicles
   - reactor containment and Auxiliary and Fuel Handling Building structures (integrity maintained)

3. Positive control - even though the residual activity will be stable and contained, steps will be taken to ensure that conditions can be assessed and appropriately maintained over the long-term. During PDMS, TMI-2 will:
   - conduct radiological and environmental monitoring
   - maintain plant protective systems (e.g., fire protection)
   - maintain plant security
   - maintain an appropriate level of emergency planning
   - provide regular reports of plant status to the NRC and public.

A monitored storage period following completion of the Cleanup Program is beneficial for several reasons.

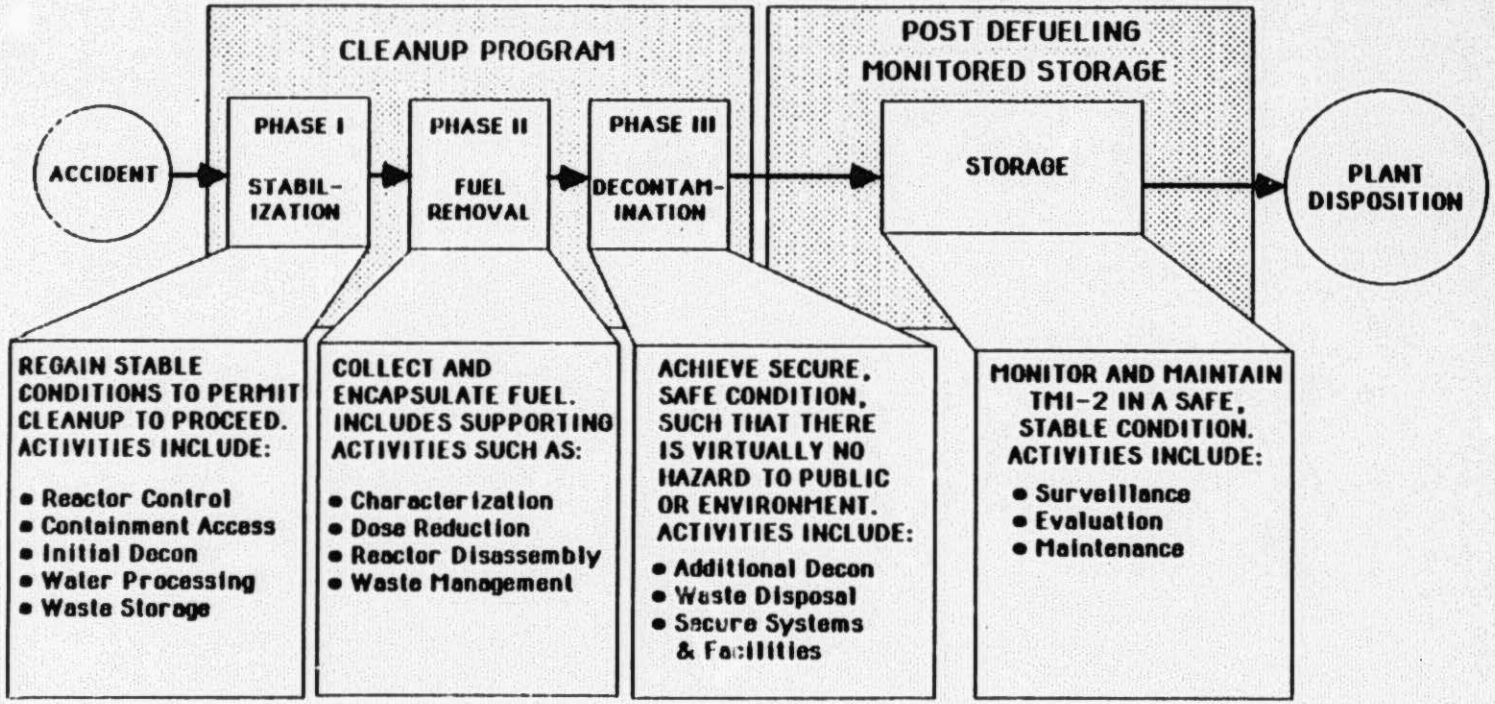
Occupational dose in the plant will be reduced during monitored storage due to the natural decay of radioactive contamination. Over an extended period, levels for the dominant isotopes (Sr^{90}, Cs^{137}) could be reduced by as much as a factor of 2. The occupational dose in radiation zones would be reduced proportionately.

The monitored storage period allows time for continued development of decontamination technology so that the most effective and efficient techniques may be applied. Further reduction in occupational exposures could be achieved through use of advanced robotic technology, automatic cleaning and chemical cleaning techniques, and advanced waste treatment methods.

This monitored storage period also allows for resolution of the current limitation on national waste disposal capabilities so that selection of processes may be less dependent on waste volume production. The result may be further reductions in occupational dose required to accomplish specific tasks.

Section 2.0 of this report describes the PDMS configuration. Section 3.0 addresses the engineering preparations required for PDMS.

FIGURE 1-1



Overall Cleanup Program Strategy

SECTION 2.0

POST-DEFUELING MONITORED STORAGE

2.1 OVERVIEW

In the intended TMI-2 plant configuration at the completion of the TMI-2 Cleanup Program, the plant will be in a safe, stable condition that can be maintained efficiently. PDMS could continue safely until the time of decommissioning of TMI-1, at which time both units could be decommissioned simultaneously. The plant will be maintained as inherently stable and monitored during this period.

Radioactive material will have been removed or contained and systems will be in place to provide for radiation monitoring, contamination control, access control, and other appropriate support requirements. Systems not needed will have been stabilized and deactivated. Other systems, such as the polar crane, will be mothballed. Additionally, disposal of remaining processed water and shipment of radioactive waste generated during the TMI-2 Cleanup Program will be ongoing and planned for completion during the first year of PDMS.

Maintenance of the plant during PDMS will be conducted under the TMI-2 10 CFR 50 license. NRC-approved Technical Specification requirements for PDMS will govern surveillance, monitoring, and support activities necessary to ensure maintenance of the safe and stable plant condition and protection of the health and safety of the public.

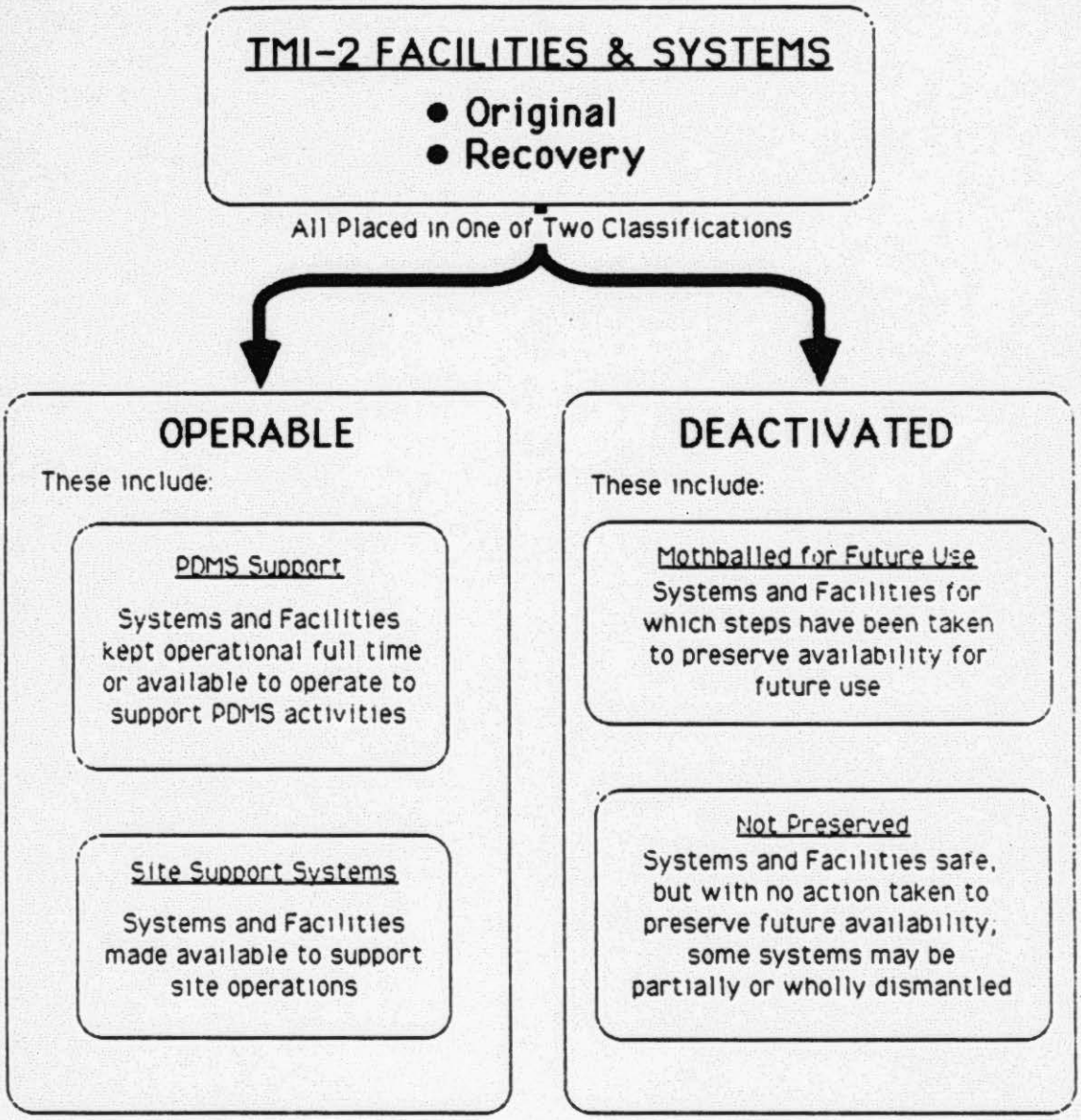
2.2 PLANT FACILITIES AND SYSTEMS

All original TMI-2 systems, components, and facilities, as well as those added to the plant as part of the recovery effort, will have been classified as "operable" or "deactivated," and configured accordingly. See Figure 2-1 for the classification of systems.

2.2.1 Facilities

TMI-2 Boundary. The TMI-2 plant will remain enclosed within the TMI site protected area during PDMS. Within the contiguous plant structures, there will be an identifiable boundary between TMI-1 and TMI-2 (Figure 2-2).

FIGURE 2-1



CLASSIFICATION OF FACILITIES AND SYSTEMS

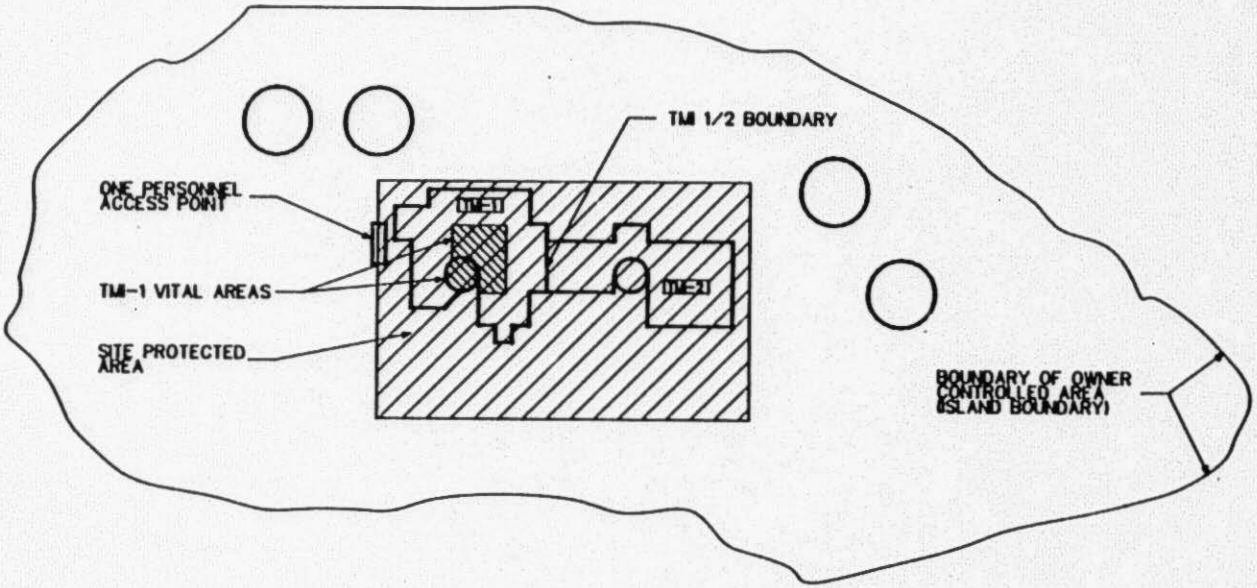


FIGURE 2-2 TMI BOUNDARIES

TMI-2 facilities will be locked with access controlled by the site security force. Within TMI-2, areas requiring radiological controls will be managed in accordance with established procedures.

Reactor Building. The reactor building normally will be locked and containment will be maintained functional as a contamination barrier in accordance with the PDMS Technical Specifications. Prior to plant inspections, the reactor building atmosphere will be controlled. The reactor building will be purged to assure the reactor building atmosphere meets industrial safety standards and ALARA conditions. At least one of two redundant trains of the reactor building ventilation system will be designated as operable for use, as needed. During system maintenance or repair, inspections may be postponed. Limited duration entry into the reactor building without active ventilation is possible.

Radiological conditions which are expected to be achieved inside the reactor building are presented in Section 2.4. These conditions will allow regular personnel access for inspection and maintenance at the 305' elevation and above-grade elevations and limited duration access to selected areas of the basement.

The plan for the reactor vessel head, plenum, and defueling-related equipment is as follows:

- The vessel head will remain at its present shielded storage location;
- The plenum will be stored dry, in the deep end of the fuel transfer canal; and
- The service structure, defueling platform, and internals indexing fixture will remain in their present locations, on the reactor vessel.

Both the reactor vessel and fuel transfer canal will be drained and will be maintained essentially dry.

Systems within the reactor building not required to remain operable will be deactivated. Reactor building power circuits will be de-energized except for those required for PDMS monitoring, inspection and surveillance equipment, and other PDMS support equipment. Prior to each inspection inside the reactor building, additional circuits will be energized to provide lighting and power for required equipment.

Auxiliary Building. The auxiliary building will be locked but accessible for regular inspection and surveillance.

The building exhaust system and filter will be maintained operable and will be operated as required. The auxiliary building sump system will remain operable.

In the auxiliary building, low-voltage electrical power distribution panels and some loads (e.g., lighting, fire detector, sump level detection) will remain energized. Emergency lights will be maintained. Most loads of 480 AC and above will be de-energized at the switchboards and/or motor control centers. However, selected loads (e.g., welding receptacles, unit heaters, and exhaust ventilation) will remain energized and available for use, as needed, during PDMS.

Fuel Handling Building. The fuel handling building exhaust system and filter will be maintained operable and will be operated as required. All fuel canisters, Submerged Demineralizer System (SDS) vessels, and Defueling Water Cleanup System (DWCS) liners will be removed from the spent fuel pools and shipped off-site. The SDS system will remain intact (i.e., including piping, structure, instrumentation) but drained and flushed. Both pools will be drained. The fuel transfer tubes will be closed and secured prior to PDMS.

Other Facilities. For the most part, the service facilities outside of the protected area fence are useful to the site and will remain operable. Some facilities inside the fence will be kept operable to support PDMS activities or site operations. Appendix A provides a current listing of these facilities.

2.2.2 Systems

As previously noted, some systems will be required and maintained operable. All other TMI-2 plant systems will be deactivated. Of the deactivated systems, a select few will be mothballed for future use (e.g., polar crane). All other deactivated systems have no function and will be placed in a safe, stable shutdown condition. In general, liquid systems will be drained, isolated, and de-energized. Systems will be sealed, as necessary, to contain residual radioactive material. Appendix A provides further detail on PDMS system conditions.

Plant systems will be modified, as needed, to provide the required capabilities. For example, the remote monitoring capability for the fire protection system, currently located in the TMI-2 control room, may require relocation.

2.3 RESIDUAL FUEL

Prior to the commencement of the TMI-2 defueling work, an estimated 290,000 pounds of core debris was located within the plant. Practically all of this material was contained in the reactor vessel with very small amounts contained in the reactor building basement and other plant systems. During the Cleanup Program, extensive effort has been made to locate all of the fuel. Defueling plans address removal of fuel material from identified locations. While practically all of this fuel will be removed, relatively small amounts will remain in the plant. Most will be enclosed in systems and components located within the reactor building. The amount of fuel remaining and its location will be such that criticality is not possible.

As a prelude to PDMS, the residual amounts of fuel in the various plant systems and components will be quantified. Plant systems and components containing fuel will be evaluated to ensure subcriticality. The program used to quantify residual fuel will apply various fuel detection techniques including: gamma spectroscopy, neutron monitors, and solid sample extraction. Each of these techniques have been proven effective previously at TMI-2.

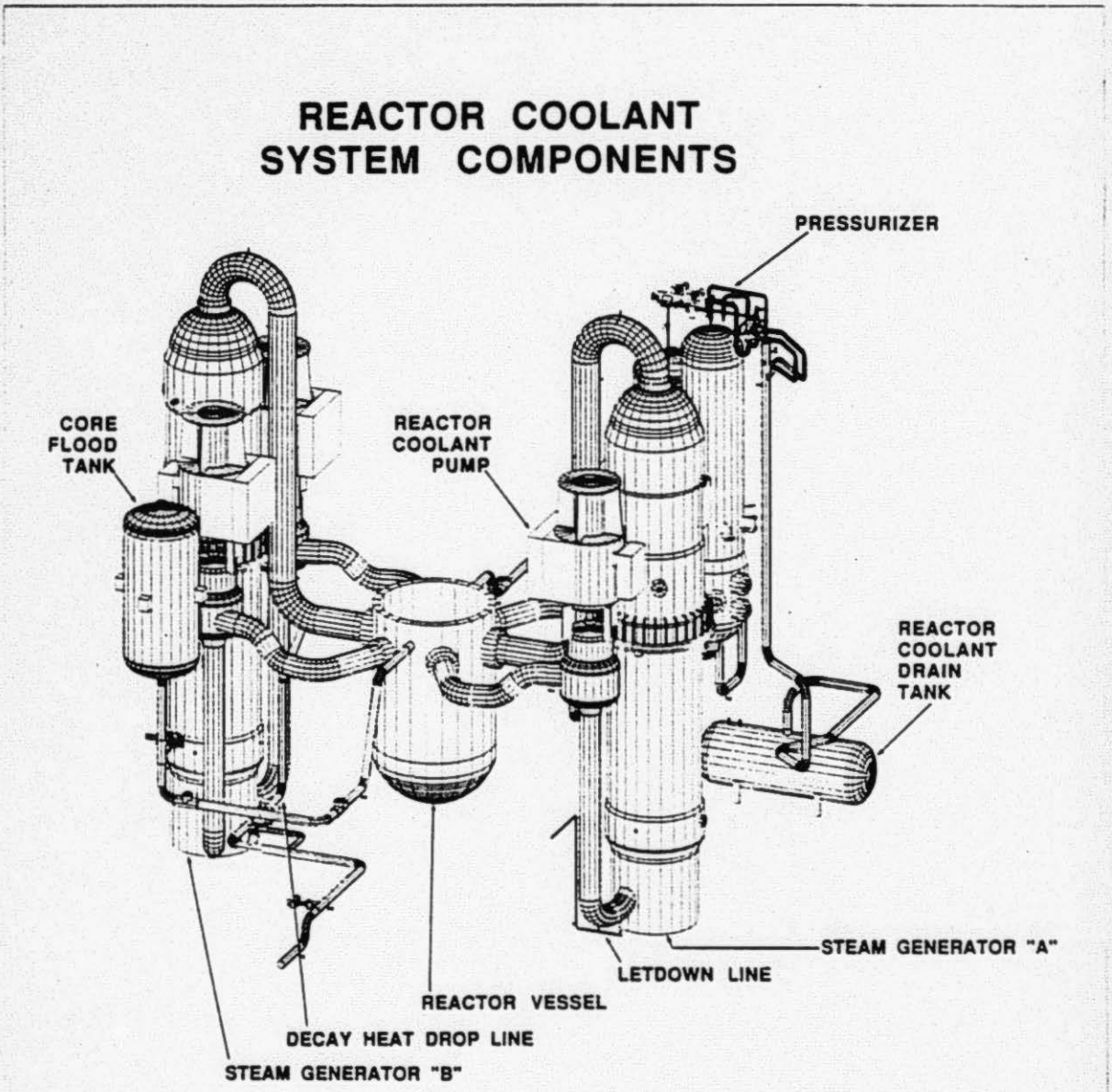
The small quantity of residual fuel that will remain following defueling will be substantially less than the threshold for low strategic significance as defined in 10 CFR 73.2 (y)(3) i.e., "10,000 grams or more of Uranium-235 contained in uranium enriched above natural but less than 10 percent in the U-235 isotope." (NOTE: At an average enrichment of 2.5%, this threshold translates to 400kg of TMI-2 fuel.)

Some possible residual fuel locations outside the reactor vessel and currently estimated quantities of fuel are listed in Table 2-1. The physical layout of the locations and Reactor Coolant System components is depicted in Figure 2-3. It is expected that all locations will contain significantly less than the minimum critical mass of fuel or that physical constraints will assure criticality cannot occur.

TABLE 2-1
POSSIBLE EX-VESSEL LOCATIONS CONTAINING FUEL

	Current Estimated Quantity of UO_2 Kg
Reactor Building:	
Reactor Coolant System (RCS)	
reactor coolant pipes pressurizer steam generators reactor coolant pumps	15-125
Outside RCS	
upper plenum assembly reactor building basement core flood tanks makeup and purification demineralizers letdown line and coolers	5-15
Auxiliary and Fuel Handling Building (AFHB):	
AFHB pipe systems AFHB drains, floors and sumps	<5
TOTAL	25-150

FIGURE 2-3


REACTOR COOLANT SYSTEM COMPONENTS
PRESSURIZER
CORE FLOOD TANK
REACTOR COOLANT PUMP
REACTOR COOLANT DRAIN TANK
STEAM GENERATOR "A"
LETDOWN LINE
REACTOR VESSEL
DECAY HEAT DROP LINE
STEAM GENERATOR "B"

Criticality safety will be assured without regard to the presence or absence of water or other moderators, reflectors or poisons. Appendix B provides additional detail on criticality evaluations.

2.4 RADIOLOGICAL CONDITIONS

A major objective for the completion of the TMI-2 Cleanup Program is to substantially improve the radiological conditions in the reactor building and the auxiliary and fuel handling building (AFHB), prior to PDMS, such that there is no health risk to the public or environment and minimal risk to radiation workers. The work necessary to achieve this condition will be assessed, taking into account:

- Environmental and safety impacts
- ALARA considerations based on access requirements during the balance of cleanup and during post-defueling monitored storage.

The decontamination and dose reduction efforts are expected to achieve cleanup levels for much of the plant approximating those found in operating plants. Projected radiological conditions are based on current knowledge of plant conditions and the assumed effectiveness of various planned decontamination techniques. Table 2-2 provides a listing of projected general radiological conditions. These levels are intended only as goals. Pre-PDMS decontamination work will proceed toward these goals consistent with ALARA.

10 CFR 50, Appendix I, establishes numerical guidelines for radioactive material in effluents from light-water power reactors. The purpose of the guidelines is to ensure that radioactive material released to unrestricted areas (e.g., off-site) is kept as low as is reasonably achievable. Meeting the Appendix I guidelines ensures the health and safety of the public. Maintaining in-plant radiological conditions during PDMS similar to those described in Table 2-2 will ensure that potential off-site releases from TMI-2 will be limited to a small fraction of the 10 CFR 50 Appendix I limits during normal conditions.

TABLE 2-2
TMI-2 CLEANUP PROGRAM RADIOLOGICAL GOALS

AREA DESCRIPTION	GENERAL AREA DOSE RATE R/hr
REACTOR BUILDING[1]	
Refueling Canal	<0.015
Elevation 347' and Above (Except D-ring)	<0.03
Elevation 305' to 347'	<0.07
Basement (El. 282')[2]	<35
AUXILIARY BUILDING[1]	
Corridors	<0.0025
Other Areas	<0.05
FUEL HANDLING BUILDING[1]	
Corridors	<0.0025
Other Areas	<0.05
OTHER BUILDINGS	
Turbine Building	<0.0025
Chemical Cleaning Building (except EPICOR II pump area to be left operable)	<0.0025
Service Building Containment Drain Tank Area	<0.0025

NOTE:

1. Conditions pertain to general area; excludes "hot spots" (e.g., basement block wall) and those that are locked high radiation areas (e.g., seal injection valve room).

2. The basement, which currently is not accessible other than with robots, is expected to be decontaminated to a level which will permit limited personnel access to selected areas where the dose will be reduced to 10 R/hr or less.

Throughout the cleanup, worker doses have been minimized through effective dose management techniques (ALARA) and radiological control practices. Since it is expected that off-site releases during normal conditions will be no more than a small fraction of 10 CFR 50, Appendix I limits, there would be no measurable benefit to the health and safety of the public by accomplishing additional cleanup beyond the conditions described in Table 2-2.

Radiological conditions will be assessed regularly during PDMS. Additional decontamination work will be undertaken, if necessary, to maintain safe, NRC-approved conditions.

2.5 PDMS LICENSE CONDITION

There are no specific requirements defining the state of licensing for a nuclear facility such as TMI-2. Most provisions of 10 CFR 50 that relate to routine nuclear reactor operations do not apply directly. Neither does the existing regulatory guidance relative to decommissioning. Nevertheless, in developing specific, proposed licensing conditions for NRC approval, GPU Nuclear will consider the existing regulatory guidance as an indicator of acceptable conditions. Such considerations, coupled with general regulations with which TMI-2 must comply, will govern maintenance of conditions during PDMS. Appendix B provides additional discussion of potentially applicable regulations.

Type of License. TMI-2 is currently licensed under 10 CFR Part 50. It is intended that the facility license be maintained under the provisions of 10 CFR 50 but limited to "possession only" status during PDMS. The TMI-2 Technical Specifications will be modified to be consistent with the requirements of the proposed PDMS configuration.

Radiation Protection. Current regulations promulgated by 10 CFR 20, "Standards for Protection Against Radiation," establish standards for protection against radiation hazards arising out of activities under licenses issued by the NRC. During PDMS, there will be areas requiring varying levels of access control due to radiological conditions. TMI-2 will continue to comply with applicable requirements of 10 CFR 20.

Radiation and Environmental Monitoring. In-plant radiation monitoring will satisfy radiation survey requirements and ensure compliance with 10 CFR 20. Environmental monitoring will ensure compliance with the Technical Specifications.

Off-Site Dose Criteria. Various regulations establish permissible limits for off-site radiation exposures resulting from the operation of licensed nuclear reactors and other nuclear fuel cycle activities. These include 10 CFR 20, 10 CFR 50 Appendix I, 10 CFR 100, 40 CFR 190, and the EPA Protective Action Guidelines. The planned licensing basis for off-site dose criteria applicable to the PDMS has been derived from these existing regulations and applicable precedents and selected to be demonstrably safe with respect to the radiological implications of PDMS. Specifically, 10 CFR 50, Appendix I has been established as the PDMS standard. A small fraction (i.e., less than 10%) of the Appendix I off-site dose limits is expected to be maintained for normal conditions prevailing during PDMS and the potential off-site radiological doses resulting from postulated off-normal conditions will be within the 10 CFR 50 Appendix I limits.

Licensed Operators. 10 CFR 50.54(K) requires an operator or senior operator licensed pursuant to Part 55 to be present at the controls at all times during the operations of the facility.

10 CFR Part 55 "Operators' Licenses" states, "The regulations contained in this part apply to any individual who manipulates the controls of any facility licensed pursuant to Part 50 of this chapter and to any individual designated by a facility licensee to be responsible for directing the licensed activities of licensed operators."

The essential element of the above listed requirements is the "Controls" of the facility. "Controls", as defined by 10 CFR 55.4(f) means "...apparatus and mechanisms the manipulation of which directly affect the reactivity or power level of the reactor."

With the completion of reactor vessel defueling, the reactor core will have been removed and no controls will be required to ensure the reactor remains subcritical; therefore, the requirement for licensed operators will no longer exist.

Control Room. Current regulations require a Control Room from which actions can be taken to operate a nuclear power unit. The license, which will specifically preclude "operation" of TMI-2, will obviate the requirement to staff a Control Room in accordance with 10 CFR 50, Appendix A, Criterion 19.

Quality Assurance. A modified Quality Assurance (QA) Plan will be implemented during the PDMS. This plan will apply to any activities for which management and administrative controls are needed in order to comply with the Technical Specifications and applicable regulations.

Emergency Planning. Emergency planning for TMI-2 will be focused on response to external events and will comply with the TMI site plan. It is envisioned that the TMI Site Emergency Plan will incorporate all emergency response requirements for TMI-2. Analysis indicates that the maximum potential release during the worst possible postulated transient would not reach the currently established levels requiring implementation of off-site emergency response, i.e., the potential to exceed EPA Protective Action Guides is physically nonexistent.

Security Requirements. The TMI-2 plant will remain enclosed within the TMI site protected area during PDMS. The plant will remain secure even though TMI-2 will not contain Special Nuclear Material of any strategic significance.

Fire Protection. Preparation and reconfiguration of the plant for PDMS will include positive actions to reduce the potential fire hazard. Fire protection will be provided during PDMS for those systems and facilities essential to PDMS. In addition, fire protection will be provided for facilities and systems consistent with the requirements of the American Nuclear Insurers and OSHA.

Fire protection will be provided by fire detection sensors maintained operational throughout the plant and portable fire suppression equipment strategically located in the plant. The system will remain functional and can be placed in service expeditiously. Active fire protection service will be maintained in plant areas housing operational systems.

Ventilation Requirements. During PDMS, it is planned that the reactor building and auxiliary and fuel handling building ventilation systems be

maintained operable to meet industrial safety requirements. A preventive maintenance program will be implemented to provide reasonable assurance of operability. In addition, to limit off-site releases to "As Low As Reasonable Achievable," filters and monitors will be maintained on all engineered radioactive effluent pathways.

Electric Power Systems. Normal electric service will be provided for systems required to support PDMS. Emergency backup electric power systems will not be required.

Technical Specification Content. With the removal of the core fuel material from TMI-2, the risk to the health and safety of the public and the impact on the environment is negligible. Therefore, the TMI-2 Technical Specifications for PDMS will be reduced in detail and complexity. The primary emphasis will be directed to:

- Maintaining containment functional as a contamination barrier
- Monitoring in-plant radiological conditions
- Monitoring environmental conditions.

The Technical Specifications will include appropriate controls and monitoring of potential release pathways to the environment to ensure off-site doses from all potential liquid and airborne pathways are consistent with required limits.

2.6 PDMS ACTIVITIES

The TMI-2 plant will be safe, stable and secure during PDMS. The plant condition will reflect a philosophy which assures inherent stability, effective containment and positive control. Once the TMI-2 Cleanup Program goals are attained, as discussed in Sections 2.1 through 2.5, and the plant evolves to PDMS, routine monitoring, inspections, surveillance and maintenance will be conducted. Reports will be provided to the NRC and public on a regular basis updating facility status.

2.6.1 Initial PDMS Activities

The level of activity is expected to be greatest early in PDMS. During this period, the principal activity will be directed to extensive monitoring. It

is expected that an initial program of data acquisition and assessment will be necessary to ensure that plant conditions and trends are well understood. Table 2-3 presents the planned activities to monitor and inspect TMI Unit 2. Further detail on the Radiological and Environmental Monitoring Programs is provided in Appendix C.

In the reactor building, auxiliary building, and fuel handling building, entries will be conducted for purposes of visual inspection, radiation survey, and recording of plant conditions. Particular attention will be paid to variations in data and trends. Entry frequency and scope will be determined by experience and need.

2.6.2 PDMS Continuing Operations & Maintenance (O&M)

There will be inspection, surveillance and maintenance activities required on a continuing basis during PDMS. These activities will be conducted by trained and qualified personnel under direct GPU Nuclear managerial control and will include:

- Regular containment entries for inspection and monitoring
- Regular verification of containment as a contamination barrier
- Technical Specification equipment surveillance
- Technical Specification calibrations
- Routine solid and liquid waste processing (i.e. resulting from PDMS activities)*
- Waste handling and shipping (i.e., PDMS-generated waste)
- System operations required during PDMS (e.g., periodic operation of reactor building purge)
- Maintenance of systems and buildings
- Housekeeping
- Response to natural events (e.g., installing flood doors)
- Emergency response (e.g., fire or personnel injury).

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*Does not include processing and disposal of the pre-PDMS processed water, which is addressed in GPU Nuclear letter 4410-86-L-0114 dated July 31, 1986, "Disposal of Processed Water."

TABLE 2-3
ANTICIPATED INITIAL PDMS MONITORING/INSPECTIONS

MONITORING/INSPECTION	INITIAL FREQUENCY	ENTRY REQUIRED
REACTOR BUILDING -		
Sump Level Monitoring	Continuous	
Radiological Survey • Airborne Radioactivity Measurement • Smear Survey • TLD Placement • General Area Survey	Monthly*	Yes
Fire Detection	Continuous	
External Isolation Checklist	Quarterly	
AUXILIARY/FUEL HANDLING BUILDING -		
Sump Level Monitoring	Continuous	
Radiological Survey • Airborne Radioactivity Measurement • Smear Survey • TLD Placement • General Area Survey	Monthly*	Yes
Fire Detection	Continuous	
Interior Visual Inspection • General Conditions • Animal Intrusion • Housekeeping	Monthly*	Yes
MONITOR RELEASES		
Unit 2 Effluents	Continuous	
Off-site Environmental Monitoring	Continuous	
Ground Water Monitoring	Quarterly	

*GPU Nuclear anticipates that the initial frequency will decrease (e.g., quarterly) based on an evaluation of data accumulated during the initial period.

2.6.3 Additional PDMS Activities

It may be necessary or desirable to conduct additional decontamination or other maintenance-related activities during PDMS. Required systems (e.g., ventilation, lighting and power, and water processing) will be identified and maintained operable.

2.6.4 Support Services

Several types of support services will be required during PDMS, although the level of effort should be modest. These services can be provided readily as part of the existing site support. Support services required for PDMS include:

- Radiological controls
- Environmental monitoring
- Engineering and analysis
- Quality assurance
- Emergency planning
- Security
- Licensing
- Communications
- Records management

Records will be archived at the end of the TMI-2 Cleanup Program. Proposed type records include:

- Plant radiological conditions
- Accountability survey results
- Radioactive materials status
- Environmental radiological analysis results
- PDMS isolation status
- Drawings and specifications
- Engineering change memoranda (ECMs) and engineering change authorization (ECAs)

SECTION 3.0

ENGINEERING PREPARATIONS FOR POST-DEFUELING MONITORED STORAGE

The primary goal of PDMS is to establish and maintain a safe, stable and secure plant condition which ensures the health and safety of the public. The preparations for PDMS, when completed, will immobilize or isolate all remaining contamination within the plant, reconfigure the plant facilities and systems, and leave the plant in a condition which permits regular inspections, surveillance and maintenance.

Preparation for PDMS requires the following major activities:

- Planning and engineering
- Area decontamination
- Disposal of liquid and solid radwaste inventories
- Equipment/systems deactivation
- Isolation and access control for radioactive or contaminated areas
- Modification and activation of PDMS support systems
- Preparations for inspections and surveillance and continued maintenance activities.
- Pre-PDMS fire inspection
- Pre-PDMS radiation surveys
- Completion of post-defueling survey

Also required will be the revision and/or cancellation of current procedures, and preparation of new procedures to guide PDMS activities.

The planning and engineering for PDMS will require considerable effort because of the widely divergent and large number of activities to be completed. The scope of this effort includes engineering and design, licensing, procurement, preparation of detailed work packages, safety reviews, and formal review and approval.

The final phase of the preparation activities is the general cleanup, final equipment line-up checks, data acquisition, and establishment of an empirical data base.

APPENDICES

A. System And Facilities Configuration

B. Licensing and Safety Considerations For PDMS

C. Radiological And Environmental Monitoring Programs

APPENDIX A

SYSTEM AND FACILITIES CONFIGURATION

OVERVIEW

At the completion of the TMI-2 Cleanup Program, the plant will be in a safe, stable and secure condition that can be maintained for an extended period. This status will be maintained for a period which may extend to the time of decommissioning of TMI-1. Therefore, the plant configuration during PDMS is based on long-term stability requirements.

Residual radioactivity will be immobilized or contained and systems will be in place to provide for monitoring, contamination control, access control, and other support requirements. Systems not needed will be deactivated.

The TMI-2 10 CFR Part 50 License will be amended for PDMS and the Technical Specification requirements will be restricted to surveillance and monitoring activities necessary to ensure protection of the health and safety of the public during PDMS.

A.1 CRITERIA

There are two general classifications with respect to system status: operable or deactivated.

The evaluation criteria addressed in selecting the appropriate classifications are:

a. Plant stability
b. Radiological protection effectiveness
c. Cost-effectiveness
d. Long-term manageability
e. Licenseability

The status of each system or facility at TMI-2 during PDMS shall be classified operable or deactivated. Operable systems generally support ongoing PDMS activities. Within the category of systems classified as deactivated, there are two subcategories, mothballed and not preserved. No other alternatives need be considered.

Plant stability is closely tied to radiological protection effectiveness. Contamination control is a radiological concern which makes the plant more stable and acceptable. Deactivating as many systems as possible increases stability by reducing fire risks, potential contamination spread, and industrial accident risks and minimizes post-recovery operating costs. It is possible to propose a variety of plant configurations that satisfy criteria (a) through (e) above; alternative configurations may be equally acceptable. This appendix recommends an acceptable system and facilities configuration.

A.2 STATUS OF SYSTEMS AND FACILITIES

As previously discussed, plant systems and facilities will be categorized as those to be maintained operable to support PDMS and those to be deactivated. This section describes the functional characteristics and relevant aspects of each category.

A.2.1 PDMS Support Systems and Facilities. PDMS support systems will remain operable to provide radiological monitoring and control, surveillance, physical plant protection, contingency waste processing, and personnel protection or support during PDMS. Identification of the systems which will provide this support is provided in Section A.3.

A.2.2 Deactivated Systems and Facilities. Existing plant systems and facilities that are not required for PDMS support will be deactivated to further enhance plant stability.

Deactivated systems will be decontaminated to an extent consistent with good ALARA practices and retained within the TMI-2 plant. These systems will be drained of liquid, sealed if internally contaminated, and de-energized. Draining of a system includes removal of disposable filters and demineralizer resin beds. The requirement to drain systems is based on minimizing the mobility of radioactive contamination and eliminating the maintenance and corrosion associated with wet systems. Deactivated systems that contain residual, adherent contamination will be sealed unless proper deactivation techniques specifically call for venting in which case systems will be vented through appropriate filters. Systems will be de-energized to enhance fire protection and industrial safety. Non-contaminated systems will be deactivated in a similar manner except that sealing will not be required.

During PDMS, no additional activities (e.g., maintenance or operation) will be directed to these systems.

Mothballed systems are a special class of deactivated system. Many of the same deactivation steps will be applied. In addition, preventive maintenance will be applied in order to lay-up system components in a preserved state. Mothballed systems are expected to have future value to TMI-2.

A.3. FUNCTIONAL REQUIREMENTS

The objective of PDMS is to place the plant in a safe, stable and secure condition that ensures protection of the public health and safety and requires moderate effort to maintain. Modification of facilities and operation of systems is limited to that required to provide industrial safety, ensure security against unauthorized entry, and ensure public health and safety. Systems and equipment not required for PDMS monitoring, contamination containment or security will be deactivated to enhance plant stability. The deactivation process will not inhibit future dismantling, salvaging, or refurbishing of systems and equipment. When the facility has been prepared for PDMS, contamination will be essentially immobilized and the following systems and functions will be maintained operable.

A.3.1 Ventilation. In the PDMS configuration, the reactor building purge and exhaust system and the ventilation system for the auxiliary and fuel handling buildings will be maintained operable to satisfy industrial and radiological requirements. For example, the reactor building purge system will be operated on an "as needed" basis to control airborne radioactivity in containment. Filters and monitors will be maintained on all radioactive effluent pathways.

A.3.2 Water Processing. A water processing capability will be maintained to dispose of rain water, ground water in-leakage, and condensation collected in the buildings during high humidity conditions. This processing will be accomplished with the EPICOR II.

A.3.3 Domestic Water. This system will be used only in support of system flush or for personnel hygiene. Overall system use will be minimal.

A.3.4 Electric Power. Normal electric power service will be maintained only for radiation monitoring systems and alarms, lighting circuits, heat tracing, fire protection systems and alarms, surveillance monitoring systems and alarms, and other support systems. Deactivated equipment will be de-energized. Most of the power circuits retained will consist of low voltage and relatively low maintenance components. A Class 1E power supply will not be required.

A.3.5 Flood Protection. Flood protection will continue to be provided by passive barriers including the site dike and bulkhead doors.

A.3.6 Fire Protection System (Detection and Suppression). Fire protection will be provided for PDMS support systems and to satisfy industrial safety concerns. Portable fire extinguishers will be maintained at selected locations and fire detection systems will remain operable. Yard hose stations will be operable and interior hose stations will be capable of being returned to service expeditiously.

A.3.7 Waste Disposal-Liquid (WDL). The primary use of this system is to collect and remove water in-leakage. The water will be removed from the sumps and held in the miscellaneous waste holdup tank until an appropriate quantity is accumulated. The accumulated water will be batch processed through the EPICOR II system. Operation of the WDL system is expected to be infrequent.

A.3.8 Waste Storage. During PDMS, solid waste generation is expected to be minimal. Quantities of waste generated should be easily handled by the existing on-site temporary storage facilities pending shipment to a licensed disposal site.

A.3.9 Radiation Monitoring. Radiation monitors and alarms will remain in operation at strategic locations throughout the facility (e.g., in the plant vent stack). Revised operating procedures will be developed to govern the frequency of monitor inspection. When ventilation systems are operated, the existing isokinetic stack monitor will be monitored.

A.3.10 Sump Drains. Selected sump drains will remain operable to collect the in-leakage of water.

A.3.11 Security. Security for TMI-2 is intended only to prevent unauthorized entry. On-site security systems and alarms will be maintained and monitored. Based on site requirements and TMI-2 considerations, the existing protected area will be maintained.

A.3.12 Communications. Telephone communication will be maintained at certain locations within TMI-2. The in-plant paging system will also be maintained operable.

A.4 CONCLUSIONS

A.4.1 Systems. A current listing of planned PDMS support systems is contained in Table A-1. All systems not designated for PDMS support will be mothballed or deactivated as shown in Table A-2.

A.4.2 Facilities. If a facility contains an PDMS support system, the facility must remain functional to the extent required to support system operations. Supporting and deactivated facilities are listed in Table A-3 and A-4, respectively.

Site facilities not covered above include the solid waste handling facilities and systems associated with the environmental monitoring program. These systems and facilities are required for continuing operation of the TMI site.

TABLE A-2

DEACTIVATED TMI-2 SYSTEMS

PRE-FIX	SYSTEM DESCRIPTION	REMARKS
AL	Acetylene (Lab)	All bottles of gas removed from plant and all lines purged.
AM	Ammonia	All ammonia removed from plant.
AR	Argon (Lab)	All bottles of gas removed from plant and all lines purged.
AS	Start-up, Aux. Steam	
BA	Breathing Air	This system is a manifold attached to the "SA" system.
BS	Reactor Building Spray	
CA	Chemical Addition/Sampling	
CAE	Cond. Air Extract Filtra	This system is a post-accident addition to the "VA" system.
CF	Core Flooding	
CH	Cont. Air Control Envel. HVAC	
CL	Chlorine	All chlorine removed from plant.
CLT	Chem. Lab Trlr. Exh. Sys.	
CO	Condensate	
CRD	Control Rod Drive	
CW	Circulating Water	
DC	Decay Ht. Closed Cooling Htr.	
--	Diesel Gen. (Safety Related)	
DF	Diesel Fuel and Starting Air (Safety Related Diesels)	
DG	Gray and White Diesels Fuel Transfer System	
DH	Decay Heat Removal	
DPW	Decon Process Water	
DS	Dewatering Station	
DSA	Decon Service Air	
DTA	Defueling Test Assembly	
DW	Demineralized Water	
DWC	Defueling Water Cleanup	All equipment to remain in-place for possible future decontamination operations.

TABLE A-2 (Cont'd)

DEACTIVATED TMI-2 SYSTEMS

PRE-FIX	SYSTEM DESCRIPTION	REMARKS
EB	Environmental Barrier	
ED	Earthquake Detection	
EF	Emergency Feedwater	
EX	Bleed Steam	
FCC	Fuel Trans Canal Fill & Drain	The FCC is a single pump, some hoses, valves, and piping tied into the spent fuel cooling system.
FH	Fuel Handling	
FL	Gas-Driven Flood Pumps	
FW	Feedwater	
GR	OTSG Chem. Clng. Sys.	
GS	Gland Steam	
HD	Heater Drains	
HV	Heater Vents	All bottles of gas removed from plant and all lines purged.
HY	Hydrogen	
IA	Instrument Air	
IC	Intermed Closed Clng. Wtr.	
LO	Lube Oil - Turbine	
LR	Leak Rate Test	
LTB	Long Term OTSG-B Cooldn.	
MA	P-10 Count Gas (Lab)	All bottles of gas removed from plant and all lines purged.
MDH	Mini Decay Heat	
ML	Methane (Lab)	All bottles of gas removed from plant and all lines purged.
MO	Moisture Separator	
MS	Main Steam	
MU	Makeup & Purification	All demineralizer resin beds removed. Containment isolation valves locked closed to prevent possible fuel debris migration into containment.

TABLE A-2 (Cont'd)

DEACTIVATED TMI-2 SYSTEMS

PREFIX	SYSTEM DESCRIPTION	REMARKS
NB	Nitrogen Blanketing	
NL	Nitrogen (Lab)	
NM	Nuclear Plant Nitrogen	
NO	Nitrous Oxide (Lab)	
NR	Nuc Services River Htr	
NS	Nuc Svs Closed Clng Htr	
PC	Penetration Cooling	
PFH	Personnel Access Fac HVAC	
PL	Propane (Lab)	All bottles removed from plant and all lines purged.
PP	Penetration Pressurization	
PW	Processed Wtr Storage and Distribution	System will remain intact and capable of reactivation in the future.
RBC	RB Chilled Water	
RB	Reactor Bldg Normal Clng	
RC	Reactor Coolant	
RCF	RC Feed Heat	
RDW	RB Decon Water	
RD	RCP Motor Oil Drains	
RR	RB Emgcy Clng River Water	
SA	Station Service Air	
SC	Secondary Svc Closed Clng	
SDS	Submerged Demin System	Components will be retained for possible decon activity during the PDMS operations.
SF	Spent Fuel Cooling	
SGC	OTSG Chemical Clean System	
SN	Sampling Nuclear Systems	
SNS	Temporary Nuc Sampling	
SO	Seal Oil Sys-Generator	
SPC	Standby Pres Control	
SR	Secondary Svc River Water	

TABLE A-2 (Cont'd)

DEACTIVATED TMI-2 SYSTEMS

SS	Secondary Plant Sampling Sys	
SV	S.G. Secondary Vents & Drains	
SW	Screen Wash Water	
SWS	Sump Water Sucker	
TNS	Temp Nuc Svc Closed Clng	
THG	Temp Waste Gas	
VA	Condenser Air Extract	
VE	Vents	
VL	Vacuum (Lab)	
WDG	Waste Disposal - Gas	
WDS	Waste Disposal - Solid	All spent resins and sludges removed from storage tanks.
WDW	Waste Hdlg & Pkg Demin Water	
WH	Waste Handling	
WT	Water Treatment	
YM	Misc Instrumentation	

TABLE A-3

OPERABLE TMI-2 FACILITIES/EQUIPMENT

FACILITIES/EQUIPMENT	REMARKS
Reactor Building	Facility is operable only to the extent necessary to support operating systems.
Fuel Handling Building	Facility is operable only to the extent necessary to support operating systems.
Auxiliary Building	Facility is operable only to the extent necessary to support operating systems.
Chemical Cleaning Building	Facility supports operation of EPICOR II system.
River Water Pump House	Facility is operable only to the extent necessary to support operating systems.
Plant Security	Security requirements during PDMS will be based primarily on preventing unauthorized access to TMI-2.
Flood Protection Doors	Manually installed flood protection doors will be available for water ingress protection.
ISHSF (Carport)	Facility is operable to support site needs.
Long-term Storage Modules	Facility is operable to support site needs.
Solid Waste Hdlg & Pkg Facility	Facility is operable to support site needs.
Laundry/Respirator Facility	Facility is operable to support site needs.

TABLE A-4

DEACTIVATED TMI-2 FACILITIES/EQUIPMENT

FACILITIES/EQUIPMENT	REMARKS
Diesel Generator (DG) Building Polar Crane	Mothball for future use in plant refurbishing or decommissioning.
Gray & White Diesel Generators	
Turbine Building	
Service and Control Building Processed Water Pump House Mech. Draft Cooling Tower Natl. Draft Cooling Tower Circ. Water Pump House Circ. Water Chlorinator House Cont. Air Control Envelope Fac.	Aircraft warning lights will remain operable.

APPENDIX B

LICENSING AND SAFETY CONSIDERATIONS FOR POST-DEFUELING MONITORED STORAGE

B.1 SAFETY AND ENVIRONMENTAL CONSIDERATIONS

A prerequisite for PDMS is that the condition of the plant during this period is safe for on-site and off-site personnel, and benign in its impact on the environment. The preliminary assessment indicates that safety and minimal environmental impact can be achieved. The considerations in this preliminary assessment include the occupational doses arising from PDMS activities, a review of the potential pathways of radionuclides to the environment, an assessment of the most limiting (i.e., bounding) conditions, and a preliminary estimate of off-site doses from those bounding conditions.

Safety and minimal environmental impact are achieved when the following conditions are met:

1. Nuclear criticality is precluded.
2. All required functions (e.g., maintenance, inspections) can be accomplished without exceeding regulatory limits or GPUN administrative guidelines concerning radiation exposure.
3. Releases from the plant under normal or abnormal conditions do not threaten the health and safety of the public and:
   a. are small fractions of those allowed by regulatory requirements and applicable guidelines, and
   b. are substantially below values that would call for off-site protective measures.
4. Plant effluents have insignificant impact on the environment.

In addition to these conditions, PDMS has been evaluated to ensure that radiation exposures to workers and public will be ALARA. Adherence to the above conditions will ensure compliance with the corporate policy on safety and application of the ALARA principle to minimize exposures within the corporate guidelines. Because the corporate administrative guidelines are more restrictive than the regulatory limits, adherence to GPUN's criteria also ensures compliance with applicable regulations.

B.1.1 Safety Assessment. Prior to PDMS, the major fraction of the radionuclide inventory will have been shipped off site or decayed, and no anticipated PDMS activities will generate sufficient energy to cause dispersal of the remaining contamination. The two conditions for significant off-site radiological hazards (i.e., a large radionuclide inventory and a mechanism for transport and dispersal) are absent during PDMS. A first step in the safety assessment is to ascertain that these conditions are maintained by preventing the possibility of a re-criticality of any residual fuel remaining in the plant.

B.1.1.1 Prevention of Criticality. Each of the plant systems and components containing fuel will be evaluated to ensure subcriticality. The criteria used for the evaluation are based on the following conservative assumptions:

- 3% enriched UO2 (whole fuel pellets)
- Optimum moderation using unborated water
- The smallest critical dimension, and
- Water reflection

The minimum critical mass of UO2 was determined to be approximately 93 kg. The evaluation conservatively neglected the presence of poisons (fixed and soluble) and structural material. A mass of 70 kg of UO2, representing 75% of the above minimum critical mass, will be used as a conservative limit to ensure the prevention of criticality subsequent to defueling. The criteria which will be used to evaluate and ensure subcriticality are the following:

a. The total accumulation of residual fuel (UO2) outside the RCS and connected systems will be less than 70 kg.
b. Components comprising the RCS and connected systems which are neutronically isolated(1) will each contain less than 70 kg of fuel.
c. Components comprising the RCS and connected systems which are not neutronically isolated(1) will contain an aggregate of less than 70 kg of fuel.

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(1) Neutronic isolation of fuel quantities (or units) is achieved when the transmission of neutrons between units of fuel is insignificant because of such phenomena as particle attenuation and dispersion.

d. As an alternative to criterion "b or "c", aggregate quantities of fuel may exceed 70 kg provided those quantities are demonstrated to be adequately subcritical for all credible conditions.

One option which can be used for evaluating non-isolated regions containing fuel is an approach referred to as the "Alternate Storage Criteria" described in the Nuclear Safety Guide TID-7016, Revision 2 (NUREG/CR-0095). The "Alternate Storage Criteria" is an accepted standard approach for demonstrating subcriticality. The Nuclear Safety Guide provides a method of assessing the criticality safety of fissile material stored in various types of containers. Fissile material stored in accordance with this technique will have a Keff $\leq$0.93. The fuel remaining at the TMI-2 plant following defueling is expected to be much less than the maximum quantity that would be allowed and still meet the limitations in the Nuclear Safety Guide. Thus, it will be demonstrated that the remaining quantity of fuel debris will be subcritical.

Criticality safety will be assured without regard to the presence or absence of water or other moderators, reflectors or poisons.

B.1.1.2 Occupational Safety. No major activities anticipated during PDMS will involve significant occupational radiation exposure hazards. Routine PDMS activities in a radiation environment consist of inspections to meet safety and regulatory requirements, maintenance of systems remaining operable to support PDMS, and any needed decontamination in support of these activities. Normal radiation protection procedures will be in place. Because PDMS activities will involve environments generally substantially less hazardous than those experienced in the TMI-2 Cleanup Program, occupational exposures are expected to be well within the corporate goals and applicable regulatory requirements.

In addition to the consideration of occupational safety, explicit consideration is given to the principle of keeping occupational exposures ALARA.

B.1.1.3 Potential Radionuclide Releases. The potential for release of significant quantities of radionuclides during PDMS is substantially reduced from that during normal operation, or any of the previous post-accident

phases, as a result of the reduced radionuclide inventory and the absence of inherent transport processes.

a. Routine Releases

Airborne releases to the environment during routine PDMS activities will consist of any airborne contamination released from the AFHB and reactor building atmospheres. Discharge pathways are controlled, HEPA-filtered, and monitored. Releases are expected to be well within established limits.

Liquid systems will be drained and deactivated prior to PDMS, except for systems needed occasionally to process batches of accumulated contaminated liquids. The major sources of such liquids are expected to be groundwater in-leakage and collected precipitation, and occasional small quantities of fluids used for local decontamination. Liquid releases will be controlled and monitored and are expected to be well within the allowable discharge limits.

b. Accidental Releases

Unanticipated events that could result in radionuclide releases exceeding those during normal conditions can be further grouped into internally and externally initiated events.

Internally generated events include those unanticipated occurrences arising from the conditions or activities postulated during PDMS. Because there are no major activities planned during PDMS, there is no known event which would involve a major fraction of the residual inventory of radionuclides. Although no specific mechanisms have been identified, a major fire in the reactor building or AFHB which is assumed to result in release of essentially all loose surface activity in the building, has been postulated as the theoretical bounding case. In addition, internally generated events include process or industrial accidents; e.g, releases resulting from a local decontamination accident, or accidental damage to contaminated piping systems. These events involve only local sources of contamination and, therefore, will not exceed the bounding case.

The external events for the TMI-2 site are tabulated and analyzed in detail in the Final Safety Analysis Report (FSAR), and include seismic events, floods,

windstorms, and aircraft crashes. The FSAR analyses for these events have been reviewed with respect to their potential to cause limited releases to the environment.

The reactor building and auxiliary and fuel handling buildings (AFHB) structures are the existing barriers to the release of residual radionuclide inventory. The reactor building and AFHB structures are designed to withstand the postulated external events. In addition, the flood protection dike remains intact and will be maintained throughout PDMS because it provides flood protection for the entire site.

From the review of internally and externally generated events, it is concluded that off-normal conditions during PDMS are bounded by the conditions postulated for a fire in the AFHB or reactor building involving essentially all of the loose contamination in that structure. Because the qualification of seismic structures has been maintained, postulated externally generated events will not result in conditions potentially more severe than those of the bounding case.

B.1.2 Bounding Off-Site Radiological Impact. The radioactivity that remains following completion of the TMI-2 Cleanup Program will be located primarily as residues in closed piping systems that have been drained or in surface films closely adherent to painted or exposed concrete surfaces. In addition, any residual sediment remaining following bulk sediment removal in reactor building and AFHB sumps at the El. 282' level of the reactor building would contribute to the inventory of suspendable radionuclides. It is assumed that the residual sediment will be in a readily suspendable form, which could become airborne in the turbulence created by a postulated fire. The total inventory of remaining radionuclides is dominated by that in the block wall of the enclosed stairwell in the reactor building basement. The activity in the block wall is absorbed in the concrete material and is not available as a source for airborne release. In the long term, the radionuclides in the block wall could diffuse along their concentration gradients or be leached by changing moisture content so that a fraction may reach the surface and thereby become available for suspension.

Another important factor in the consideration of residual contamination is the content of transuranic elements. On the basis of the samples analyzed to

date, as well as the analysis of the course of the accident, the bulk of the transuranic elements is associated with residual fuel.

In order to estimate a maximum accidental source term, it is assumed that 5% of the activity in the block wall (currently estimated to be about 12,000 Ci of Cs-137 and 6000 Ci of Sr-90) will be available for suspension from its surfaces during the postulated fire. To a lesser extent, contaminated painted and exposed concrete surfaces are assumed to contribute to the fission product inventory available for suspension. It is also assumed that essentially all of the fuel fines remaining in the RB basement after sediment removal will be available for suspension during the fire. The resulting radionuclide inventory available for suspension during the postulated bounding event, therefore, is about 1000 Ci of cesium and strontium, and about 2 kg of fuel fines.

Suspension factors observed experimentally for fires and short-term (accident) meteorological dispersion are assumed in the calculation of the off-site consequences of this event. The estimated consequences of this hypothetical event are not only well within all applicable regulatory guidelines, but are insignificant by comparison with annual background doses.

B.2 PDMS LICENSING CONSIDERATIONS

In addition to defining the physical and radiological conditions for PDMS, it is necessary to address licensing requirements. This section provides a review of relevant regulatory material and defines the general licensing requirements for TMI-2 during PDMS.

B.2.1 License Conditions. During the PDMS period, GPUNC will be licensed under 10 CFR 50 to "possess but not to operate" the facility. This form of license is generally termed a "possession only" license and includes those provisions of 10 CFR 50 that are relevant to the PDMS period. Under this license condition, TMI-2 can be maintained in a safe, stable condition for an extended period.

B.2.2 General Regulatory Considerations. There are several aspects of PDMS which have a broad impact on the applicability 10 CFR 50. The fact that TMI-2

will not possess nuclear fuel other than that which remains as adherent or isolated contamination, eliminates the applicability of regulations directly associated with nuclear reactor operations and related support systems; e.g., safety-related equipment and core cooling systems. These aspects of PDMS are discussed in the sections that follow.

B.2.2.1 TMI-2 Core. The TMI-2 core will be removed from the reactor vessel and shipped off-site for long-term storage in the custody of the Department of Energy. There will be no nuclear fuel on site during PDMS other than that which remains as adherent or isolated contamination. In this condition, there can be no core-related events, such as the typically postulated transients and accidents, around which a significant number of the regulations are constructed. Further, the postulated "design basis events" that result from a lack of core cooling cannot occur. Consequently, the protective systems that are incorporated into nuclear power plant design to prevent core damage during "design basis events" will not be required.

B.2.2.2 Safety Related Equipment. Safety related electrical equipment is defined in 10 CFR 50.49 as that equipment relied upon to remain functional during and following design basis events to ensure: 1) the integrity of the reactor coolant pressure boundary; 2) the capability to shutdown the reactor and maintain it in a safe shutdown condition; and 3) the capability to prevent or mitigate the consequences of accidents that could result in potential off-site exposures comparable to the 10 CFR 100 guidelines. During PDMS, there is expected to be no equipment or activity which would require a safety-related classification.

B.2.3 Specific Regulatory Considerations. Subsequent to the consideration of the general regulatory aspects of PDMS, specific regulations were reviewed and evaluated to determine the regulatory requirements applicable to PDMS. Regulatory considerations with potentially significant impact are discussed below.

B.2.3.1 Fire Protection. 10 CFR 50, Appendix A, Criterion 3; 10 CFR 50, Appendix R; and 10 CFR 50.48 address fire protection requirements for nuclear power plants. 10 CFR 50, Appendix R and 10 CFR 50.48 address measures for safe shutdown capability. With the TMI-2 nuclear core removed and shipped off-site, the plant will be in an inherently "safe shutdown." Therefore, these fire protection criteria will not apply to TMI-2 during PDMS.

Nevertheless, GPU Nuclear recognizes its responsibility and plans to provide protection from potential fires. Preparation and reconfiguration of the plant for PDMS will include positive actions to reduce the potential fire hazard. Fire protection will be provided for systems to be used during PDMS, and a fire protection program will be maintained consistent with the requirements of the American Nuclear Insurers and OSHA.

Fire protection will be provided by fire detection sensors maintained operational throughout the plant and portable fire suppression equipment strategically located in the plant. The system will remain functional and can be placed in service expeditiously. Active fire protection service will be maintained in plant areas housing operational systems.

8.2.3.2 Licensed Operators. 10 CFR 50.54(K) requires an operator or senior operator licensed pursuant to Part 55 to be present at the controls at all times during the operations of the facility.

10 CFR Part 55 "Operators' Licenses" states, "The regulations contained in this part apply to any individual who manipulates the controls of any facility licensed pursuant to Part 50 of this chapter and to any individual designated by a facility licensee to be responsible for directing the licensed activities of licensed operators."

The essential element of the above listed requirements is the "Controls" of the facility. "Controls", as defined by 10 CFR 55.4(f) means "...apparatus and mechanisms the manipulation of which directly affect the reactivity or power level of the reactor."

With the completion of reactor vessel defueling, the reactor will have been removed and no controls will be required to ensure the reactor remains subcritical; therefore, the requirement for licensed operators to be present at the controls will no longer exist.

Additionally, 10 CFR 50.54 requires a Senior Reactor Operator (SRO) or a Fuel Handling SRO to be present during core alterations, including fuel handling or transfer. Because the only fuel that will remain on site during PDMS is that which exists as adherent and/or isolated contamination, there will be no fuel handling or transfer and, thus, no need or purpose to maintain SROs and/or Fuel Handling SROs.

B.2.3.3 Control Room. 10 CFR 50, Appendix A, Criterion 19, requires a control room from which actions can be taken to operate a nuclear power unit. The PDMS license, which will specifically preclude operation of TMI-2, will obviate the requirement to staff a control room in accordance with that criterion. However, GPU Nuclear may choose to use the control room as a convenient, centralized location from which to monitor PDMS activity.

B.2.3.4 Radiation Monitoring. Radiation monitoring is required to satisfy effluent monitoring, radiation survey, and 10 CFR 20 requirements during PDMS. There are at least two forms monitoring can take: 1) fixed radiation monitors, and 2) physical surveys. ALARA, accessibility, type of task, and frequency of monitoring are factors which will be considered in determining which type of monitoring program is most appropriate for each designated activity during PDMS.

B.2.3.5 Ventilation. There will be no specific 10 CFR 50 requirements for operability of the reactor building purge and exhaust system or the ventilation system for the auxiliary and fuel handling buildings during PDMS. However, these ventilation systems will be maintained operable to meet industrial safety requirements and a preventive maintenance program will be implemented to provide reasonable assurance of operability. In addition, to limit off-site releases to "As Low As Reasonable Achievable," filters and monitors will be maintained on all engineered radioactive effluent pathways.

B.2.3.6 Security. 10 CFR 50 and 10 CFR 73 define security requirements for nuclear power plants. The security requirements are based on the possession of significant quantities of special nuclear material (SNM) and protection from theft or sabotage. During PDMS, TMI-2 will possess less than a low strategically significant quantity of SNM. In addition, the consequences of a release of a portion of the remaining radionuclide inventory because of a postulated sabotage event are negligible. Therefore, security requirements during PDMS will be based primarily on preventing unauthorized access to TMI-2.

Both TMI units will be enclosed within a single protected area. This option provides the required security for both units, entails the minimum plant physical modifications, and provides the greatest flexibility.

B.2.3.7 Quality Assurance. GPU Nuclear will implement a modified 10 CFR 50, Appendix B, Quality Assurance Program for TMI-2 during PDMS. This program will include application of all appropriate quality assurance functions (i.e., monitoring, inspection, surveillance, audit, and reviews). The program will apply to:

a. Structures, systems, and components required to be operational by the TMI-2 Technical Specifications
b. Radiological monitoring (including on-site and environmental monitoring)
c. Radiological protection
d. Radioactive waste management

A Quality Assurance Plan for PDMS will be published.

B.2.3.8 Off-Site Dose Criteria. Various regulations establish permissible limits for off-site radiation exposures resulting from the operation of licensed nuclear reactors and other nuclear fuel cycle activities. These include 10 CFR 20, 10 CFR 50 Appendix I, 10 CFR 100, 40 CFR 190, and the EPA Protective Action Guidelines. The planned licensing basis for off-site dose criteria applicable to the PDMS has been derived from these existing regulations and applicable precedents and selected to be demonstrably safe with respect to the radiological implications of PDMS. Specifically, 10 CFR 50, Appendix I has been established as the PDMS standard. A small fraction (i.e., less than 10%) of the Appendix I off-site dose limits is expected to be maintained for normal conditions prevailing during PDMS and the potential off-site radiological doses resulting from postulated off-normal conditions will be within the 10 CFR 50 Appendix I limits.

B.2.3.9 Emergency Plan. The primary regulatory requirements for emergency planning are embodied in 10 CFR 50.47; 10 CFR 50.54(q); and 10 CFR 50, Appendix E. Other documents such as NUREG-0654, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants"; NUREG-0396, "Planning Basis for the Development of State and Local Government Radiological Emergency Response Plans in Support of Light Water Nuclear Power Plants;" and EPA-520/1-75-001, "Manual of Protective Action Guides and Protective Actions for Nuclear Incidents" provide guidance and support for the regulations.

The basis for the regulations and associated guidance is the general assumption that one emergency action level could degrade to a higher level, eventually requiring off-site protective actions, e.g. evacuation. The protective action guidelines (PAG) provided in EPA-520/1-75-001 establish a threshold of off-site exposures, above which action may be necessary. The lowest PAG threshold for off-site exposures is less than 5 rem thyroid and less than 1 rem whole body. Additionally, GPU Nuclear and the NRC have established 1 rem bone dose as a lower PAG limit.

There is no postulated event that would result in releases exceeding 10 CFR Appendix I criteria; thus, PAG threshold levels will not be exceeded. In fact, the dose resulting from the postulated worst-case transient event would be less than the release limits for normal operating power plant effluents. Based on these criteria, an emergency plan is not required for TMI-2 during PDMS.

However, there are emergency planning requirements not directly related to off-site exposures (e.g., plans to cope with an injured, contaminated individual and natural phenomena). Also, since TMI-2 is located on a multi-unit site, an emergency on the site might require response by TMI-2 personnel. Such requirements will be incorporated in a site emergency plan.

B.2.3.10 Surveillance and Radiation Surveys. Surveillance requirements for nuclear power facilities are established in 10 CFR 50.36 as part of the facility Technical Specifications. Regulatory Guide 1.86, "Termination of Operating License for Nuclear Reactors", although not directly applicable to the PDMS condition, provides guidance for nuclear power plants in a state similar to PDMS. Regulatory Guide 1.86 states that surveillance and commensurate security should be provided to ensure that the public health and safety are not endangered. Regulatory Guide 1.86 suggests quarterly radiation surveys to verify the stability of radioactive conditions. Regulatory Guide 1.86 also requires radiation surveys at least quarterly to verify the stability of plant conditions. PDMS survey activities will be based on these standards.

B.2.3.11 Organization. 10 CFR 50.43(b)(6)(i) requires the applicant's Final Safety Analysis Report (FSAR) to include the organizational structure, allocations of responsibilities and authorities, and personnel qualification

requirements. These same requirements must be addressed during the PDMS period. The organizational structure and responsibilities for PDMS will be described in appropriate PDMS licensing documentation.

B.2.3.12 Events for Safety Analysis. The safety analyses, such as are presented in Chapter 15 of the FSAR, include consideration of internally and externally generated events. Events considered applicable during PDMS are discussed in Section B.1.

B.2.3.13 Flood Protection. 10 CFR 50, Appendix A, Criterion 2, requires that nuclear power plants be designed to withstand the effects of natural phenomena. These natural phenomena include floods. TMI-2 was designed to withstand the probable maximum flood for the site. These protective features will be maintained during the PDMS commensurate with the required protection.

The requirement for flood protection during PDMS is limited to the maintenance of the physical barriers and closures necessary to prevent intrusion of flood waters. In addition to the postulated flood being a low probability event, the potential impact of a flood at TMI-2 during PDMS is far less than that considered in the FSAR. Therefore, the existing FSAR analysis adequately bounds the PDMS condition.

B.2.3.14 Tornado/Hurricane Protection. 10 CFR 50, Appendix A, Criterion 2, requires that nuclear power plants be designed to withstand the effects of natural phenomena. These natural phenomena include tornados and hurricanes. TMI-2 was designed to withstand the maximum tornados and hurricanes appropriate for the site. The physical barriers necessary to avoid damage from these events will be maintained during the PDMS period.

In addition to these events being low probability, their potential impacts on TMI-2 during PDMS are far less than those considered in the FSAR. Therefore, the FSAR analysis bounds the PDMS condition.

B.2.3.15 Seismic Requirements. 10 CFR 50, Appendix A, Criterion 2, requires that nuclear power plants be designed to withstand the effects of natural phenomena. These natural phenomena include earthquakes. All systems, components, and structures designated seismic Category I were designed to withstand the appropriate earthquake ground accelerations with no loss of function.

The requirement for seismic protection during PDMS is limited to the maintenance of the structural integrity of contamination barriers as opposed to the original design criteria requiring no loss of function. Therefore, the existing design capability of both seismic Category I and other systems and structures is extremely conservative relative to the required function during PDMS. The consequences of a seismic event during PDMS is bounded by the existing FSAR analysis.

B.2.3.16 Electric Power. Normal electric service will be provided for systems required to support PDMS. Emergency backup electric power will not be required.

B.2.3.17 Radiation Protection. Current regulations, as promulgated by 10 CFR 20, "Standards for Protection Against Radiation," establish standards for protection against radiation hazards arising out of activities under licenses issued by the NRC. During PDMS, residual contamination will exist in the TMI-2 plant and there will be areas requiring varying levels of access control due to radiological conditions. TMI-2 will continue to comply with applicable requirements of 10 CFR 20.

B.2.4 Technical Specifications. The Safety Analysis Report for a nuclear power plant uses analyses to demonstrate that the facility has been designed so as not to present undue risk to the health and safety of the public. While some analyses are quantitative and others are qualitative, all rely on underlying assumptions such as system lineups, specific parameters, and the maintenance of equipment over plant life. The fundamental purpose of the facility technical specifications is to establish criteria to verify equipment capabilities necessary to preserve those underlying assumptions that could vary with time; preservation of the basis of the safety analysis is assured by compliance with the Technical Specifications.

With the removal of the core material from TMI-2, analyses necessary to demonstrate that the facility does not pose an undue risk to the health and safety of the public during PDMS are greatly reduced. The technical specifications for TMI-2 during PDMS will be modified accordingly, but will be organized as prescribed by NUREG-0103, "Standard Technical Specifications for Babcock and Wilcox PWRs." The construction of those sections, and a brief description of their contents, is given below.

B.2.4.1 Definitions. This section contains the definitions of terms used within the body of the Technical Specifications.

B.2.4.2 Safety Limits. 10 CFR 50.36(c)(1)(i)(A) and (B) address the requirements for this section. Safety limits are limits established for important process variables to protect the integrity of certain physical barriers. If any safety limit is exceeded, the reactor must be shutdown. Limiting safety system settings are those settings for automatic protective devices that relate to those process variables having significant safety functions. With the fuel removed from TMI-2, there will be no need for safety limits or limiting safety system settings. Therefore, this section will not apply to TMI-2 during PDMS.

B.2.4.3 Limiting Conditions for Operation (LCO). 10 CFR 50.36(c)(2) and (3) address the requirements for this section. LCOs are the lowest functional capability or performance level of equipment required for safe operation of the plant. With TMI-2 in PDMS, some plant features will fall within the intent of this requirement. The primary elements expected to be included within this section are:

- Containment functional as a contamination barrier
- Monitoring requirements for radiological conditions (in-plant and environmental)

Surveillance requirements ensure that the equipment and/or structures required by LCOs are able to perform their intended function. As such, for those LCOs that apply during PDMS, there will be corresponding surveillance requirements to demonstrate compliance.

B.2.4.4 Bases. 10 CFR 50.36(a) addresses the requirements for this section. Bases are the technical justification for the LCOs. In as much as LCOs will be present in the TMI-2 Technical Specifications, there will be corresponding bases.

B.2.4.5 Design Features. 10 CFR 50.36(c)(4) addresses the requirements for this section. Design features are those features of the facility (i.e., construction materials and geometric arrangements) that, if altered or

modified, would have significant effect on safety and are not specifically identified as a safety limit, LCO, or surveillance requirement. The containment barrier would fall into this category during PDMS.

B.2.4.6 Administrative. 10 CFR 50.36(c)(5) addresses the requirements for this section. The administrative section will include those administrative controls and functions necessary for the safe maintenance of TMI-2 in PDMS. Examples are procedural review, audits, plant modifications, quality assurance, safety review, and radiation controls, as well as the overall management organization.

B.2.4.7 Environmental Technical Specifications. 10 CFR 50 establishes the requirements to monitor liquid and gaseous effluents from nuclear power plants. These requirements are part of the Environmental Technical Specifications and will be required for TMI-2 during PDMS.

APPENDIX C

RADIOLOGICAL AND ENVIRONMENTAL MONITORING PROGRAMS

C.1 RADIOLOGICAL CONTROLS

During the PDMS, radiological surveys will be conducted on a regular basis to monitor radiological conditions in the auxiliary and fuel handling buildings (AFHB) and the reactor containment building. These surveys will generally be performed in conjunction with the entries to perform visual inspections. The surveys will consist of air sampling, loose surface contamination sampling, and radiation dose rate surveys. In addition, TLDs may be placed in fixed locations and changed out periodically to monitor dose rates over a longer term. Radiological survey results will be reviewed and evaluated for trends to provide early detection of changing radiological conditions.

It is anticipated that routine radiological surveys normally will be performed where access has been established for visual inspection, preventive maintenance, or other routine tasks. High radiation, high contamination, sealed areas and other normally inaccessible areas will not be accessed for routine surveys unless access is required for some other purpose. Radiological support of work during PDMS will be conducted in accordance with radiological controls procedures and good radiological work practices (ALARA).

"Locked high radiation" areas may be established and maintained during PDMS. Locked doors outside of the reactor building and AFHB will be periodically inspected visually. For any "locked high radiation" areas inside the reactor building and AFHB, reliance will be placed on access control to those buildings.

C.2 EFFLUENT MONITORING

A certain amount of in-leakage into sumps is anticipated during PDMS and periodic discharges will be necessary. The current methods of sampling and discharging will essentially remain unchanged. Initial and mid-batch samples will be taken and analyzed to quantify radioactive effluents, if any. Radioactive discharges are expected to be minimal. The pathway for these discharges will be through the industrial waste treatment system which is monitored by RML-7.

Monitoring of airborne effluents will be accomplished during ventilation of the buildings. Reactor building purge and AFHB exhaust will be operated as needed. During ventilation system operation, the station ventilation stack monitor, HP-R-219 or HP-R-219A, will provide real time monitoring of releases. In addition, backup monitoring may be provided by operating the reactor building exhaust monitors and the auxiliary building and fuel handling building exhaust monitors. During periods when the ventilation systems are not operating, airborne effluents will continue to be monitored through filtered, monitored, engineered effluent pathways.

In the AFHB, no airborne effluent discharges are anticipated (i.e., general area radiological conditions will approximate those of an operating plant). Areas and systems within the AFHB containing residual contamination sufficient to pose a potential for a release will be sealed. Periodic surveys will be performed as described in Section 1 to monitor for contamination spread. Remedial action will be taken as appropriate to minimize contamination spread or releases to the environment.

C.3 SITE ENVIRONMENTAL MONITORING PROGRAMS

GPU Nuclear maintains an extensive radiological environmental monitoring program (REMP) for Three Mile Island. This comprehensive program is operated at a level which satisfies the Technical Specifications. The current TMI REMP, which uses state-of-the-art equipment, will be able to monitor any radiation and radioactive materials in critical exposure pathways.

The program consists of collecting samples from the environment, analyzing them for radiation and radioactivity content, and interpreting the results. With emphasis on the critical pathways to man, samples from the aquatic, atmospheric, and terrestrial environments are collected. These samples include air, soil, water, finfish, milk, fruits, vegetables, groundwater, and precipitation. Thermoluminescent dosimeters (TLDs) and a real-time gamma monitoring system are placed in the environment to measure ambient gamma radiation levels.

Sampling locations have been established by considering meteorology, population distribution, hydrology, and land use characteristics of the local TMI area. The sampling locations are divided into two classes, indicator and

control. Indicator locations are those which are expected to show plant effects, if any exist. These locations were primarily selected on the basis of where the highest predicted environmental concentrations would occur. While the indicator locations are typically within a few miles of the plant, the control stations are generally at least 10 miles from the plant. Therefore, control samples are collected at locations which should be unaffected by plant operations. They provide a basis on which to evaluate fluctuations at indicator locations relative to natural background radiation and radioactivity and fallout from prior nuclear weapon tests.

The analytical results are routinely reviewed and evaluated by a qualified staff of scientists. Investigations are conducted when administrative action levels have been reached or when anomalous values are discovered. Action levels have been set low enough to provide early detection of potential environmental impacts. Corrective action is initiated, if the investigation concludes that the radiation or radioactivity is related to TMI.

A strong quality assurance program is conducted in accordance with guidelines provided by the NRC and as required by the Technical Specifications. It is documented by written policies, procedures and records. This program is designed to identify possible deficiencies so that immediate corrective action can be taken. It also provides a measure for the quality of the results. The quality assurance program is implemented by:

- Auditing the analytical laboratories
- Requiring the analytical laboratories to participate in a NRC approved quality assurance program (Interlaboratory Comparison Program)
- Requiring analytical laboratories to split and perform duplicate analyses on every tenth sample (recounts are performed when samples cannot be split)
- Splitting samples, having the samples analyzed by independent laboratories, and then comparing the results for agreement

Radiological Environmental Operating Reports are submitted annually to the NRC for review. These reports include summaries, interpretations, and analyses of the results and discuss observed impacts, if any, to the environment from plant operations. The results of land use censuses and the Interlaboratory Comparison Program are also included. Special reports are prepared and

submitted to the NRC in the event that a reporting level, as defined by the Technical Specifications, is exceeded.

The radionuclide inventories will be substantially reduced during PDMS and the mechanisms for transport and dispersal of residual activity will be limited. The Radiological Environmental Monitoring Program undergoes continuous review and, if necessary, changes will be made in response to changing site or plant conditions which could impact the environment.